

What is claimed is:

1. A chip antenna comprising:
a substrate;
a plurality of helical conductors provided on said substrate; and
5 a pair of terminals provided on said substrate,
wherein one of said plurality of helical conductors is electrically connected to one of said pair of terminals, and another one of said plurality of helical conductors is electrically connected to another of said pair of terminals.
- 10 2. The chip antenna according to claim 1, wherein said plurality of helical conductors are not electrically conductive with respect to each other.
3. The chip antenna according to claim 2, wherein said plurality of helical conductors are capacitively coupled.
- 15 4. The chip antenna according to claim 1, wherein said plurality of helical conductors are electrically connected with each other.
5. The chip antenna according to claim 4, wherein said plurality of helical
20 conductors are electrically connected to each other and formed by a single conductive film.
6. The chip antenna according to claim 1, wherein said plurality of helical conductors and said pair of terminals are formed by a same conductive film.
- 25 7. The chip antenna according to claim 1, wherein one of said pair of terminals is connected to a power feeding section for feeding a signal current to

said one of said pair of terminals and another of said pair of terminals is open ended.

8. The chip antenna according to claim 7, wherein one of said plurality of
5 helical conductors corresponds to a highest frequency of a plurality of transmitting and receiving frequencies and is connected to said one of said pair of terminals connected to the power feeding section.

9. The chip antenna according to claim 1, wherein a portion of said substrate
10 has a smaller cross sectional area than portions of said substrate on which said pair of terminals are provided.

10. The chip antenna according to claim 1, wherein said substrate comprises one of a quadrangular prism, a circular cylinder, a triangular prism, and an
15 elliptic cylinder.

11. The chip antenna according to claim 1, wherein said substrate comprises one of a circular cylinder and an elliptic cylinder, and portions of said substrate on which said pair of terminals are located are cubical in shape.

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12. The chip antenna according to claim 10, wherein said substrate is rectangular in cross section and has a longer dimension in a lateral direction than a dimension in a vertical direction.

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13. The chip antenna according to claim 1, wherein a portion of said substrate has a larger cross sectional area than another portion of said substrate.

14. The chip antenna according to claim 13, wherein said portion having the larger cross sectional area is not provided with any of said plurality of helical conductors.

5 15. The chip antenna according to claim 1, further comprising a protective film covering at least said plurality of helical conductors on said substrate.

16. The chip antenna according to claim 15, wherein said protective film comprises one of a tube-like protective film, a coated protective film, and an
10 electro-deposited film.

17. The chip antenna according to claim 1, wherein said plurality of helical conductors are formed by one of trimming said substrate which is covered with a conductive film and winding a wire around said substrate.

15 18. The chip antenna according to claim 1, wherein said chip antenna is operable to transmit and receive frequencies of at least a GSM band and a DCS-1800 telecommunication band.

20 19. The chip antenna according to claim 1, wherein said chip antenna has a length L , a height H and a width W of:

$$4.0mm \leq L \leq 40.0mm;$$

$$0.5mm \leq H \leq 10.0mm; \text{ and}$$

$$0.5mm \leq W \leq 10.0mm.$$

20. The chip antenna according to claim 7, further comprising a crown
25 conductor electrically connected to said another of said pair of terminals that is open ended.

21. The chip antenna according to claim 20, wherein said crown conductor is connected to a portion of said substrate having a larger cross sectional area than another portion of said substrate, in addition to said terminal in connection
5 to the open end, and wherein said portion having the larger cross sectional area does not include a portion provided with said plurality of helical conductors.

22. The chip antenna according to claim 20, wherein said crown conductor has one of generally a triangular shape, a square shape, a polygonal shape, a
10 circular shape and an oval shape.

23. An antenna device having a chip antenna, said chip antenna comprising:
a substrate;
a plurality of helical conductors provided on said substrate; and
15 a pair of terminals provided on said substrate,
wherein one of said plurality of helical conductors is electrically connected to one of said pair of terminals, and another one of said plurality of helical conductors is electrically connected to another of said pair of terminals, and
said chip antenna is mounted to a portable terminal in a location which is
20 a lower side of the portable terminal when the portable terminal is held in a normal use orientation.

24. An antenna device comprising:
a main board;
25 a supplementary board;
a chip antenna located on said supplementary board;
a signal processing unit provided on said main board; a power feeding

section provided on said supplemental board and operable to feed a signal; and
a crown conductor provided on said supplemental board and adapted to yield
a load capacitance,

wherein said supplementary board is in generally a same plane as said main
5 board,

wherein said chip antenna comprises:

a substrate;

a plurality of helical conductors provided on said substrate; and

a pair of terminals provided on said substrate,

10 wherein one of said plurality of helical conductors is electrically connected
to one of said pair of terminals, and another one of said plurality of helical
conductors is electrically connected to another of said pair of terminals, and

wherein one of said pair of terminals of said chip antenna is connected to
said power feeding section, and another of said pair of terminals is electrically
15 connected to said crown conductor.

25. An antenna device comprising:

a chip antenna;

a main board;

20 a power feeding section provided on said main board;

a signal processing unit provided on said main board;

a supplementary board; and

a crown conductor provided on said supplementary board,

wherein said supplementary board is in generally a same plane as said main
25 board, and

wherein said chip antenna comprises:

a substrate;

a plurality of helical conductors provided on said substrate; and
a pair of terminals provided on said substrate,

wherein one of said plurality of helical conductors is electrically connected
to one of said pair of terminals, and another one of said plurality of helical
5 conductors is electrically connected to another of said pair of terminals, and

one of said pair of terminals of said chip antenna is connected to said power
feeding section provided on said main board, and another of said pair of
terminals is electrically connected to said crown conductor provided on said
supplementary board.

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26. The antenna device according to claim 25, further comprising a
grounding plate provided on said main board, wherein said chip antenna is
placed in an orientation generally orthogonal to a side edge of said grounding
plate of said main board.

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27. An antenna device comprising:
an antenna mounting board; and
a chip antenna; provided on said antenna mounting board,

20 wherein said chip antenna comprises:

a substrate;
a plurality of helical conductors provided on said substrate; and
a pair of terminals provided on said substrate,

wherein one of said plurality of helical conductors is electrically connected
25 to one of said pair of terminals, and another one of said plurality of helical
conductors is electrically connected to the another of said pair of terminals, and

wherein said antenna mounting board is electrically connected to a circuit

board carrying circuit elements, and said antenna mounting board is arranged in a manner that a major surface of said antenna mounting board is tilted with respect to a major surface of the circuit board.

5 28. The antenna device according to claim 27, wherein an angle formed between said major surface of said antenna mounting board and the major surface of the circuit board is not smaller than 70 degrees and not greater than 100 degrees.

10 29. The antenna device according to claim 27, wherein the circuit board has a shield located between said antenna mounting board and the circuit elements on the circuit board.

15 30. The antenna device according to claim 27, wherein said chip antenna is mounted in an orientation such that a longitudinal direction of said chip antenna is generally orthogonal to side edges along a line of bonding between the circuit board and said antenna mounting board.

20 31. A communication device comprising:
a chip antenna operable to transmit a transmission signal and receive a reception signal;
a signal converter operable to convert voice into an audio signal and data into a data signal;
a transmitter operable to modulate the converted audio signal and the
25 converted data signal into the transmission signal;
a receiver operable to demodulate the reception signal received by said chip antenna into at least one of voice and a data signal;

a data input unit operable to accept a data input; and
a controller operable to control at least said signal converter, said
transmitter and said receiver,

wherein said chip antenna comprises:

5 a substrate;

a plurality of helical conductors provided on said substrate; and

a pair of terminals provided on said substrate, and

wherein one of said plurality of helical conductors is electrically connected
to one of said pair of terminals, and another one of said plurality of helical
10 conductors is electrically connected to another of said pair of terminals.

32. An electronic device for performing wireless transmission and reception
of data, said electronic device comprising:

a display operable to display a predetermined form of image;

15 an input unit operable to accept a predetermined form of data input;

a storage unit operable to store data;

a chip antenna, operable to transmit a transmission signal and receive a
reception signal; and

a transceiver operable to modulate and demodulate signals to be
20 transmitted and received through said chip antenna, respectively,

wherein said chip antenna comprises:

a substrate;

a plurality of helical conductors provided on said substrate; and

a pair of terminals provided on said substrate, and

25 wherein one of said plurality of helical conductors is electrically connected to
one of said pair of terminals, and another one of said plurality of helical
conductors is electrically connected to another of said pair of terminals.